

CLAIMSInventive
claim

1. A device comprising a structure (10) placed in tension ^{IC} between two support elements (100, 110) and a rupture device (20, 30, 40, 50) ¹¹²⁽²⁾ associated with this structure in tension (10) so as to rupture ¹¹²⁽²⁾ the latter on demand, characterized in that ¹¹²⁽²⁾ it additionally comprises a beam (150) working in compression, inserted between these two support elements (100, 110) in parallel with the structure to be ruptured (10).
2. The device as claimed in claim 1, in which the structure (10) intended to be ruptured comprises pretensioned fibers, characterized in that ¹¹²⁽²⁾ it comprises two stressing members (20, 30) arranged one on each side of the fibers (10), and ^{IC} operating means (40) designed to, on demand, bring about a relative displacement toward each other of the stressing members (20, 30), ¹¹²⁽²⁾ the latter being shaped so that, as they ¹¹²⁽²⁾ move closer together, ¹¹²⁽²⁾ they impose on the fibers (10) a radius of curvature that is below ¹¹²⁽²⁾ the threshold of curvature thereof that leads to rupture in bending.
3. The device as claimed in claim 2, characterized in that the stressing members comprise a punch (30) and retaining means (20) arranged one on each side of the fibers (10).
4. The device as claimed in either of claims 2 ^{and} 3, characterized in that the operating means (40) are of pyrotechnic type.
5. The device as claimed in one of claims 2 to 4, characterized in that the operating means (40) comprise a pyrotechnic charge (50) capable of generating a high-pressure gas and an inflatable sealed member (60) connected to the pyrotechnic

Subcl

Need fiber cutting punch

A

A

I propose multiple Dep.

I propose multiple Dep.

charge (50) and ^{How} in contact with at least one of the stressing members (20, 30) so as to bring about a relative displacement of these when said charge (50) is initiated.

5

6. The device as claimed in one of claims 2 to 5, characterized in that the structure to be ruptured (10) is made at least in part of composite material.

Improves Multiple Dependent

10

7. The device as claimed in one of claims 2 to 6, characterized in that the structure to be ruptured (10) consists of a strap.

IMD

15

8. The device as claimed in one of claims 2 to 7, characterized in that the structure to be ruptured (10) is formed on the basis of fibers chosen from the group containing carbon, glass and aramid.

IMD

20

9. The device as claimed in one of claims 2 to 8, characterized in that the element to be ruptured (10) is nonhomogeneous over its entire length: it consists essentially of fibers at the rupture zone placed facing the stressing members (30) and consists of a composite material, fibers embedded in a synthetic material, outside this rupture zone.

IMD

25

30

10. The device as claimed in one of claims 2 to 9, characterized in that the fibers that make up the structure to be ruptured (10) have a longitudinal elastic modulus in excess of 20 000 MPa.

IMD

35

11. The device as claimed in one of claims 2 to 10, characterized in that the fibers that make up the structure to be ruptured (10) have a diameter of the order of 0.1 to 25 μm , or even of 0.1 to 10 μm .

IMD

12. The device as claimed in one of claims 2 to 11, characterized in that one of the stressing members comprises a punch (30) made of high-carbon steel. *END*
- 5 13. The device as claimed in one of claims 2 to 12, characterized in that one of the stressing members comprises a punch (30) which defines a dihedron, the angle of which is between 30 and 90°, preferably of the order of 60°. *END*
- 10 14. The device as claimed in one of claims 3 and 12 to 13, characterized in that the punch (30) has an edge (33), the maximum radius of curvature r of which is defined by the relationship
- 15
$$r = [(d/2)E]/\sigma$$
- in which
- . σ represents the maximum local extensile or compressive stress,
- . E represents the longitudinal elastic modulus,
- 20 and
- . d represents the diameter or thickness of the beam consisting of a fiber (10).
- 15 15. The device as claimed in one of claims 3 and 12 to 14, characterized in that the punch (30) has an edge (33), the radius of curvature r of which is at maximum of the order of 1 mm, preferably at maximum of the order of 0.75 mm. *END*
- 30 16. The device as claimed in one of claims 2 to 15, characterized in that the length and the structure of the inflatable tube (60) are designed to mechanically decouple the pyrotechnic generator (50) and the punch (30) so as to avoid any transmission of vibration from the pyrotechnic generator (50) to the punch (30). *END*
- 35 17. The device as claimed in one of claims 2 to 16, characterized in that the operating means (40)
- 60 not in 1-4*

comprise a pyrotechnic generator (50) which has an electric initiator (56).

- 5 18. The device as claimed in one of claims 2 to 14, characterized in that the operating means (40) *IND* comprises a pyrotechnic generator (50) which has a charge (54) capable of generating a gas by combustion.
- 10 19. The device as claimed in claim 5, characterized in *IND* that the inflatable sealed member (60) is formed of a stainless steel tube.
- 15 20. The device as claimed in either of claims 5 and *IND* 19, characterized in that the inflatable sealed member (60) has a diameter of the order of 4 mm.
- 20 21. The device as claimed in one of claims 2 to 20, characterized in that the stressing means *IND* comprise a punch and retaining means (20) formed of an anvil and located one on each side of the structure to be ruptured (10).
- 25 22. The device as claimed in claim 21, characterized *IND* in that the anvil (20) is made of a material not as hard as the punch (30).
- 30 23. The device as claimed in either of claims 21 and 22, characterized in that the anvil (20) is made of medium-carbon steel.
- 35 24. The device as claimed in either of claims 21 and 22, characterized in that the anvil (20) is made based on elastomer or on a material exhibiting plastic behavior, such as aluminum, copper or lead.

25. The device as claimed in either of claims 21 to 23, characterized in that the anvil (20) has a groove or hollow facing the punch (30).
- 5 26. The device as claimed in one of claims 2 to 25 taken in combination with claim 3, characterized in that the retaining means (20) comprise two supports (22, 24) situated on the opposite side of the fibers (10) to the punch (30), the two supports (22, 24) being arranged one on each side of the edge (33) of the punch (30) in the longitudinal direction of the fibers (10).
- 10 27. The device as claimed in claim 28, characterized in that the distance separating the two supports (22, 24) is between one times, preferably two times, the diameter or thickness of the fibers (10) and the amplitude of relative displacement of the stressing means (20, 30).
- 15 28. The device as claimed in one of claims 2 to 27, characterized in that the stressing means (20, 30) are formed of two comb-shaped structures arranged one on each side of the fibers (10).
- 20 29. The device as claimed in one of claims 2 to 28, characterized in that ⁽¹²⁾it further comprises means (37, 38) designed to keep the stressing means, such as a punch (30), away from the structure to be ruptured (10) before the pyrotechnic generator (50) is operated.
- 25 30. The device as claimed in claim 29, characterized in that the temporary keeping means consist of silicone-elastomer strips (37, 38).
- 30 31. The device as claimed in one of claims 2 to 30, characterized in that the pyrotechnic generator
- 35

IMD

N

(50) is designed to emit at least 1.5 l of gas at one atmosphere.

32. The device as claimed in one of claims 1 to 31, characterized in that the element (150) working in compression is built in at one end into an element of complementary structure (100).
33. The device as claimed in one of claims 1 to 32, characterized in that ¹¹²¹³it has an annular structure.
34. The device as claimed in claim 33, characterized in that the structure to be ruptured (10) is formed of a continuous annulus.
35. The device as claimed in claim 33, characterized in that the structure to be ruptured (10) is formed of several elements distributed about the axis O-O of the structure.
36. The device as claimed in one of claims 1 to 35, characterized in that the element (150) working in compression is formed integrally with one of the two support elements (100, 110).
37. The device as claimed in one of claims 1 to 36 taken in combination with claim 3, characterized in that the element (150) working in compression also serves as retaining means (20).
38. The device as claimed in one of claims 1 to 36 taken in combination with claim 3, characterized in that the element (150) working in compression also serves as a guide for the punch (30) and, as appropriate, for an inflatable tube (60) belonging to the operating means.
39. The device as claimed in one of claims 2 to 38, characterized in that the structure to be ruptured

IND

10

V

(10) is formed of a piece of composite material equipped with an additional thickness (12, 14) at least at one of its ends.

- 5 40. The device as claimed in one of claims 2 to 39, characterized in that the structure to be ruptured (10) can be split into several strands.
- 10 (41). The device as claimed in one of claims 2 to 40, characterized in that the structure to be ruptured (10) is formed of a tubular structure.
- 15 42. The device as claimed in one of claims 2 to 41, characterized in that ^(12, 14) it comprises an ogee shape (20, 70) placed between various strands of the structure to be ruptured (10).
- 20 43. The device as claimed in claim 42, characterized in that the ogee shape (70) carries at least one punch (30).
- 25 44. The device as claimed in claim 42, characterized in that the ogee shape (20) serves as retaining means.
- 30 (45). The device as claimed in one of claims 42 to 44, characterized in that the ogee shape (70) carries a pyrotechnic generator (50).
- 35 (46). The device as claimed in one of claims 42 to 45, characterized in that the ogee shape carries several punches (30).
- (47). The device as claimed in one of claims 2 to 46, characterized in that it comprises two punches (30) associated with respective pyrotechnic generators (50) facing each zone to be severed of the structure to be ruptured (10).

IMV

↓

48. The device as claimed in one of claims 2 to 47, characterized in that it comprises at least two redundant rupture devices (20, 30, 40, 50) placed in parallel.

5

49. The device as claimed in one of claims 2 to 48, characterized in that at least certain elements (20, 30, 40, 50) of the rupture device are duplicated to guarantee the reliability of the assembly.

10